THE UIC PERMIT IS PREMATURE

The UIC regulations require that certain technical information be submitted to the Director and considered *prior* to the issuance of a permit for the construction of a new Class I well. (40 CFR 146.14(a).) Some of this required information is not present in the Application or EPA file on this project and thus has not been considered. Once the well is permitted and constructed, certain additional information must be submitted and considered prior to granting approval to operate the well. (40 CFR 146.14(b).) Some of this information or permit conditions requiring the production of some of this information are also missing. Therefore, the UIC permit is both premature and inadequate. The missing information should be obtained from the Applicant and the permit appropriately revised and recirculated for public review.

Underground Sources Of Drinking Water

The EPA concluded that "data indicates the possibility of an Underground Source of Drinking Water (USDW) occurring in this area. It is most likely to exist within the upper, unconfined aquifer above the Tulare clay in undifferentiated alluvium." (Application, Statement of Basis, p. 2.) We agree, and note that several ephemeral stream channels are present near the proposed wells which may reasonably be expected to support fresh alluvial aquifers.[1] Further, the proposed wells are close to the southern boundary of the Elk Hills Oilfield. The Tulare Formation where the wastes would be injected is exempt within the boundaries of the Oilfield, but not outside of those boundaries. (Application, Attach. 26.)

The regulations require that the Applicant submit "maps and cross sections indicating the general vertical and lateral limits of all underground sources of drinking water within the area of review, their position relative to the injection formation and the direction of water movement, where known, in each underground source of drinking water which may be affected by the proposed injection" *before* the permit to construct is issued. (40 CFR 146.14(a)(4).) The Application and project file contain none of this information. Instead, the draft permit contains a condition requiring the Applicant to collect some portion of the required information during construction of the new wells and prior to commencing injection. (Permit, Condition C.1.a, p. 9.) This condition is not adequate for three reasons.

First, the regulations explicitly require that the information that would be collected during well construction, after permit issuance, be submitted and reviewed by the Director *before* the permit is issued. Thus, EPA is proposing to issue a permit that allows collection of data which the regulations demand be in the Application.

[1] USGS, Taft, California 7-1/2 Minute Quad, Photorevised 1973, T31S, R24E, Section 18.

Second, EPA proposes to require different well construction requirements based on this post-permitting data. (Permit, Condition C.1.a.i.) Adequate well construction is essential to assure that USDWs are protected. This condition would allow modification of a very important permit condition, well design, after the close of public comment, precluding public review and violating the public review requirements at 40 CFR part 124. To avoid this violation, EPA should withdraw the draft permit and reissue it only after the Applicant collects and submits the data required by the regulations. Only through recirculation after that necessary data is collected may interested parties, as well as EPA, be assured that all USDWs will be protected by the proposed permit conditions.

Third, the condition, even if it were allowed by the regulations (which it is not), is vague as to the nature of the data that would be collected. At a minimum, the Applicant should be required to collect sufficient lithology, water level, TDS and other water quality data to map the vertical and lateral limits of USDWs within the area of review. Given the heterogeneity in the area documented in the Application, we believe this would require a minimum of seven separate 600-ft deep wells, four located at quarter points around a circle with a radius equal to the radius of review, two located between the radius of review and proposed injection wells, and one located between the two proposed injection wells. At least three of these wells should be located within the alluvial material along the ephemeral drainages within the area of review. This information should be used to revise the permit, which should then be recirculated for public review.

Injectate Analysis

The UIC regulations require that "an analysis of the chemical, physical, radiological and biological characteristics of injection fluids" be submitted and considered by the Director before the permit is issued. (40 CFR 146.14(a)(7)(iii).) The injectate characterization data in Attachment 20 of the Application (Water Balance at Peak Load) only includes major cations and anions such as calcium, magnesium, chloride, and sulfate. Trace elements and biological characteristics are not reported. Trace element composition data is essential to evaluate potential impacts on local USDWs (because the power plant's source water contains trace elements) and to assess compatibility of the injectate with formation fluids, as discussed below. Further, cooling tower blowdown may contain algae and other biological growth that could clog injection wells and the formation outside of the well.

For example, the source water for the power plant contains 4.8 ug/L of arsenic. (Application, Attach 20, West Kern Water District.) This water would be concentrated six times in the cooling tower and the blowdown would thus contain 29 ug/L of arsenic. (Application, p. 13.) This exceeds the recently proposed revision to the arsenic drinking water standard of 5 ug/L.[2] The existing Tulare

[2] National Primary Drinking Water Regulations; Arsenic and Clarifications to Compliance and New Source Contaminants Monitoring, Federal Register, v. 65, no. 121, June 22, 2000, p. 38888 *et seq*.

formation water contains 4.7 to 19.5 ug/L of arsenic. (Application, Attach. 13.) Therefore, the injection would degrade the quality of the receiving formation. Moreover, as explained below, nothing in the proposed permit prevents injection waters from migrating into the non-exempt USDW portion of the Tulare Formation immediately south of the Elk Hills Oilfield boundary. Thus, the permit also fails to protect USDWs from violations of a proposed drinking water standard when the waste front reaches that point.

Finally, it is impossible to assess the extent of potential contamination of USDWs because the Application presents only a portion of the information that the regulations require. The Applicant argues that no actual analyses are available because operations have not commenced. (Application, p. 14.) However, it is feasible to present engineering calculations of the chemical composition of the injectate. These calculations should include constituents for which primary drinking water standards have been established and which are likely to be present. The calculations should include all chemicals that are added during water use, such as biocides, corrosion inhibitors, oxygen scavengers, and chemical used to control condensate/feedwater pH and other characteristics.[3] These chemicals could cause further drinking water violations if added to the injection waters in sufficient amounts.

Monitoring Plan

The UIC regulations require that "plans (including maps) for meeting the monitoring requirements in § 146.13(b)" be submitted and considered by the Director before the permit is issued. (40 CFR 146.14(a)(13).) These monitoring requirements include “analysis of the injected fluids with sufficient frequency to yield representative data of their characteristics.” (40 CFR 146.13(b)(1).) The subject monitoring plans were not provided in the Application or any other materials in the project file that I reviewed.

The Application indicates that the only monitoring that is proposed is mechanical integrity. (Application, p. 24.) Elsewhere, the Application asserts that a sampling plan with QA/QC procedures for injectate "will be developed." (Application, p. 14.) The project file contains no evidence that this plan was ever developed. Moreover, the permit only contains a requirement that one initial sample of the injectate’s chemical composition be taken. (Permit, Condition C.1.(e).) This requirement is not of “sufficient frequency to yield representative data of [the injectate’s] characteristics” (40 CFR § 146.13(b)(1)) which includes, at minimum, quarterly reports on the chemical characteristics of the injectate. (40 CFR 146.13(c)(1)(i).)

The project file and draft permit neither contain nor require any of this information. The lack of monitoring requirements is problematic because of the

[3] See, for example, Brad Buecker, Fundamentals of Steam Generation Chemistry, PennWell, Tulsa, OK, 2000 and the Application for Certification, Elk Hills Power Project, February 1999, Table 5.12-1.

possibility that the injectate could impact USDWs and because the permit generally requires that injected wastes be nonhazardous (Permit, Condition C.6.a) but provides no method of demonstrating compliance with this condition after initial startup. This would allow the Applicant to inject hazardous or otherwise harmful wastes without being discovered.

The Applicant should be required to submit a monitoring plan to periodically characterize the injectate. To comply with UIC regulations, this plan should specify the sampling location, monitoring frequency, parameters, and methods that would be used. (40 CFR 144.43(b).) At a minimum, injectate samples should be analyzed at least quarterly immediately prior to the wellhead using EPA test methods for all of parameters listed in 40 CFR 261 that may be present. The permit should be revised to incorporate the monitoring plan and recirculated for public review.

Corrective Action Plan

The UIC regulations require a corrective action plan for any wells within the area of review which penetrate the injection zone, but which are not properly completed or plugged. (40 CFR 146.14(a)(14).) The EPA concluded that "no corrective action is needed for wells located within the Area of Review," but did not provide the basis for this statement. (Statement of Basis, p. 3.) The project file suggests that this conclusion is incorrect.

The Application identified two abandoned wells within the area of review. (Application, Attach. 1.) One was a shallow well with a total depth of 250 feet (U.S. Navy No. 1-18G). This well likely did not penetrate the injection zone, which is 565 to 618 feet below ground surface. (Application, p. 9.)

However, the second abandoned well, U.S. Navy No. 2-18G, is 1,860 feet deep and located 950 feet from one of the proposed injection wells.[4] (Application, pp. 3-4.) Based on cross section B-B', this well does penetrate the injection zone. (Application, Attach. 8.) The well was abandoned in 1934 by filling the hole from 535 feet below ground surface ("bgs") to the ground surface with dirt and capping it with one sack of cement. The condition of the hole below 535 feet bgs is unknown, but apparently contained stovepipe casing which could not be removed. Water was present in this well at 245 feet bgs at the time that it was abandoned. (Application, Attach. 2.)

The procedures that were used to cap this well, backfilling with sand, are not adequate to prevent migration of fluids between penetrated aquifers, in violation of UIC regulations. The dirt fill would allow water and injectate from the

[4] We note that the base map in Attachment 1 of the Application shows that this well is about 1,300 feet from proposed injection well 35 while the text at page 4 claims this well is 1,950 feet from proposed injection well 35 and only 950 feet from proposed injection well 15. There are similar discrepancies between other existing wells reported on page 4 of the Application and the base map.

injection zone to migrate through the dirt fill into any overlying alluvial aquifers, which may be USDWs. Wells are properly abandoned when they are filled with concrete, which prevents fluid migration in the borehole. (See, for example, 40 CFR 146.10.)

Further, this improperly abandoned well is within the area of influence of the proposed injection wells. According to calculations in Attachment 18 of the Application, the injected waste front would reach a point about 950 feet from the injection well after 18 years of operation. After 30 years of operation, the life of the proposed power plant that the wells would serve, the waste front would extend a minimum of 1,203 feet from the injection well, easily reaching and encompassing well 2-18G. Therefore, one can reasonably anticipate that this improperly abandoned well could provide a migration pathway for injected wastes to reach any overlying USDWs.

The UIC regulations require that for wells that are "improperly sealed, completed, or abandoned, the applicant shall also submit a plan consisting of such steps or modifications as are necessary to prevent movement of fluid into underground sources of drinking water ("corrective action")." 40 CFR 144.55(a). Therefore, the Applicant should be required to submit a corrective action plan to properly abandon well 2-18G. The permit should be revised to reflect the plan and recirculated for public review.

Fluid Compatibility

The UIC regulations require that, prior to granting approval for operation of Class I wells, the Director shall consider the "compatibility of injected waste with fluids in the injection zone and minerals in both the injection zone and the confining zone." 40 CFR 40 146.14(b)(6). Compatibility is important because injectate may react with the formation or its natural fluids to form precipitates that can clog the formation in the vicinity of the well bore. Wastewater treatment may be required prior to injection to prevent unacceptable pressure buildup from formation and well clogging. Further, precipitates would reduce the porosity of the formation, which would increase the rate of movement of the waste front, increasing the zone of influence of the wells.

The Application asserts, with no support whatsoever, that "incompatibility of injectate and receiving groundwater is not anticipated." (Application, p. 14.) The EPA's statement of basis is silent on this issue. However, chemical characterization data presented in the Application suggests that this assertion is not correct.

The injectate is mostly cooling tower blowdown (*ibid.*), which is rejected from the tower because it has reached the limit of saturation of compounds that may precipitate out in the cooling tower. Concentrations of calcium, sulfate, bicarbonate and silica in the blowdown, for example, are near the limits of saturation. (Application, Attach. 20.) The injectate, which is 80 to 85 degrees F

when it leaves the cooling tower, will cool when it is injected and mixes with formation water. Calcium, magnesium, and other alkaline earth metals which are present in the injectate and/or the formation water can react with carbonates, sulfate, phosphates, fluorides, silicates, and other anions in the injectate and formation, forming additional precipitates. (Application, Attachs. 13, 20.) This will cause precipitation of alkaline earth metals calcium, magnesium, barium and strontium as relatively insoluble carbonates, sulfates, hydroxides, orthophosphates, or fluorides. Further, metals such as iron, zinc, chromium and cadmium can precipitate as insoluble sulfides, hydroxides, carbonates, or orthophosphates. These precipitates will deposit in the formation around the well, reducing permeability and increasing injection pressure.[5]

Plugging by bacterial action is also a common problem. Bacterial growth can be promoted by a change in temperature caused by injection warmer cooling tower blowdown to a cooler aquifer. Therefore, the bacterial characteristics of the injectate and a mixture of injectate and Tulare Formation water should be evaluated in a compatibility test. (Driscoll 1986, p. 772. [6])

In light of this information, the unsupported assertion offered by the Applicant is not an adequate compatibility analysis. (Application, p. 14.) Moreover, the permit itself is silent on this issue and does not contain a condition requiring a compatibility analysis. Therefore, the permit should be modified to specifically require a compatibility analysis so that the compatibility determination required by 40 CFR 146.14(b)(6) can be made. The condition should be in sufficient detail to assure that the effects of changes in temperature of the saturated waste stream as well as chemical reactions between the injectate and formation fluids and reservoir formation and biological plugging are properly tested.

USDWs WOULD BE ADVERSELY AFFECTED

The UIC regulations prohibit "the movement of fluid containing any contaminant into underground sources of drinking water, if the presence of that contaminant may cause a violation of any primary drinking water regulation under 40 CFR part 142 or may otherwise adversely affect the health of persons." The burden is on the applicant to demonstrate that this requirement is met. (40 CFR 144.12.) The Applicant has not met this burden, as discussed below.

[5] Texas Department of Water Resources, Underground Injection Control Technical Assistance Manual, NTIS Report PB85-176477, April 1983, page 16.
[6] Fletcher G. Driscoll, Groundwater and Wells, 2nd Ed., Johnson Division, St. Paul, Minn, 1986.

There are at least two potential USDWs in the vicinity of the proposed injection wells. First, as discussed above, there may be overlying alluvial aquifers, particularly along ephemeral stream channels in the area. The Applicant has not provided the information necessary to determine the location and vertical and lateral extent of these aquifers. Second, the Tulare Formation itself is a USDW outside of the boundary of the Elk Hills Oilfield. The Tulare Formation within the boundary of the Elk Hills Oilfield is exempt as a source of drinking water. (Application, p. 21.) However, this exemption does not extend outside of the boundary. (Application, Attach. 26.) The proposed wells are in the southern portion of the Oilfield, only about one-half mile from the southern-most boundary of the Oilfield based on the Area of Review and Area of Influence Map included in Attachment 1 of the Application.

The Tulare Formation, outside of the boundaries of the Oilfield, meets the definition of a USDW, which include those aquifers that contain sufficient water to supply a public water system and contain less than 10,000 mg/L of total dissolved solids ("TDS"). (40 CFR 144.3.) The Application indicates that the TDS of water in the Tulare Formation ranges from 4,485 mg/L to 6,142 mg/L, less than 10,000 mg/L. (Application, p. 10 and Attachs. 13-14.) The Application also indicates that the Tulare Formation is currently providing source water for oil production activities (Application, p. 3), typically producing 80 gpm/ft. (Application, Attach. 2, well 45WS-18G.) Thus, a typical well with a 100-foot screened interval could produce 8000 gpm. In Kern County, where the Project is located, the per capita water use is about 375 gallons per day per capita.[7] Therefore, a single well could provide water to 30,720 individuals. This is enough to support a public water supply. Therefore, the Tulare Formation beyond the exempted portion within the Elk Hills Oilfield is a USDW.

As discussed above, the concentration of arsenic in the raw supply water for the Elk Hills power plant is high enough to exceed or contribute to exceedances of the currently proposed drinking water standard on arsenic. Therefore, if injectate migrates outside of the boundary of the Elk Hills Oilfield, a proposed primary drinking water standard would be exceeded and the health of any person drinking the water would be adversely affected. This is prohibited under the UIC program.

The Applicant underestimated the radius of influence of the proposed injection wells. As discussed below, two factors make it likely that injectate will migrate into non-exempt aquifers.

Area Of Review

[7] California Department of Water Resources (DWR), Urban Water Use in California, Bulletin No. 166-2, October, 1975, Table 2 and DWR, Municipal and Industrial Water Use, Bulletin No. 166-1, August 1968, Table 10.

To assure compliance with the prohibition on movement of fluid into underground sources of drinking water, the UIC regulations require that certain information be provided and considered within the "area of review" prior to issuing a permit and granting permission for operation of the injection well. (40 CFR 146.14.) The Applicant did not properly calculate the area of review of the wells. When the errors in the Applicant's calculation are corrected, the resulting radius of influence encroaches on non-exempt aquifers that qualify as USDWs.

The Applicant selected as the area of review the greater of a 0.5-mile radius around each injector or the "area of influence" calculated to be 994 feet. (Application, pp. 2, 15 and Attachs. 1 and 18.) The Applicant did not provide any authority or support for this approach. There are several problems with this approach.

First, the Applicant provided no support for the selected fixed radius of 0.5 miles, which is too low for a Class I well. Based on an EPA survey, other states and regions routinely use larger fixed radii for Class I wells, typically from 1 to 2-1/2 miles. For example, in Region V, Minnesota uses 2 miles and Illinois uses 2.5 miles. In Region VI, Louisiana uses 2 miles, New Mexico 2.5 miles, and Texas 2.5 miles. In Region VII, Kansas uses 1 mile. (Platt 3/17/98.[8])

Second, the Applicant calculated an "area of influence," which it equates to the "zone of endangering influence" defined at 40 CFR 146.6, but it did not follow the requirements prescribed in 40 CFR § 146.6. That section requires that the area of review be determined in one of two prescribed manners. First, the area of review or "zone of endangering influence" may be determined using the modified Theis equation shown in the regulations or a comparable method. (40 CFR § 146.6(a)(2).) Second, the area of review may be determined by establishing a fixed radius around the well, but *only* "[i]n the case of application(s) for well permit(s) under § 122.38." (40 CFR § 146.6(b).) The Application here is not for a well permit under § 122.38, which has not been promulgated. Therefore, the first method of calculating the area of review based on a mathematical model comparable to the modified Theis equation must be used.

The Applicant did not use a model comparable to the Theis equation for calculating this parameter. The Applicant also did not use the inputs required under the regulations. When these problems are corrected, the "area of influence" is demonstrated to extend outside of the exempted aquifer, into a USDW.

[8] S. Stephen Platt, EPA Region 3, A Underground Injection Control Summary of Regional and State Implementation of the Area of Review, March 17, 1998. (Available on EPA website.)

First, the Applicants' calculations are for 20 years while the life of the power plant that the wells would support is 30 years. The regulations state that the computation "should be calculated for an injection time period equal to the expected life of the injection well or pattern." (40 CFR § 146.6(a)(2).) The Applicant anticipates that these wells would last for the life of the proposed power plant, or 30 years. (3/9/00 RT 140:6-22.)[9] The Applicant has not proposed any other method for disposing of the plant's wastewater, which it would have had to disclose and analyze under the California Energy Commission's licensing requirements if any other disposal method was anticipated. Therefore, both EPA and the Applicant must base the area of review computation on a 30-year project life.

Second, the Applicant included contaminant dispersion in its calculations, but assumed a dispersion coefficient of only 3 feet for sandstone. Sandstones typically have a porosity of about 1% to 5%, while the subject formation is reported to have a porosity of 34%. Therefore, the assumed dispersion coefficient would underestimate the radius of influence. A higher dispersion coefficient should have been used.

Third, the equation that the Applicant used only estimates the *minimum* radial extent of spread of a wastewater and therefore is not conservative.[10] The source relied on by the Applicant states "A good estimate of the minimum distance of wastewater flow from an injection well can be made by assuming that the wastewater will uniformly occupy an expanding cylinder with the well at the center." The discussion continues, pointing out that "In most situations the minimum radial distance of travel will be exceeded, because of dispersion, density segregation, and channeling through high permeability zones. Flow may also be in a preferred direction, rather than radial, because of hydrologic discontinuities (e.g., faults), selectively oriented permeability paths, or natural flow gradients." (Warner and Lehr 1981,[11] p. 109,underlining in original.)

Fourth, the equation used by the Applicant is overly simplified, ignoring the properties of the receiving aquifer. The Tulare Formation is a confined aquifer. Injected materials travel much greater distances in confined aquifers.

Finally, this method is apparently not widely accepted as it was not reported as a method used by any of the regions that responded to EPA's survey on methods used to calculate the area of review. (Platt 3/17/98.)

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[9] Transcript of Evidentiary Hearing before the California Energy Resources Conservation and Development Commission, Elk Hills Power Project, Docket No. 99-AFC-1, March 9, 2000. Available on CEC website at www.energy.ca.gov.

[10] D.L. Warner, Monitoring of Class I Injection Wells, In: John A. Apps and Chin-Fu Tsang (Eds.) Deep Injection Disposal of Hazardous and Industrial Waste. Scientific and Engineering Aspects, Academic Press, 1996, pp. 425-526.

[11] Don L. Warner and Jay H. Lehr, Subsurface Wastewater Injection. The Technology of Injecting Wastewater into Deep Wells for Disposal, Premier Press, Berkeley, CA, 1981.

Therefore, we calculated the area of review using the Theis equation from 40 CFR 146.6, modified to account for the fact that the Tulare Formation is a confined aquifer and to evaluate a UDWS downgradient and in the same aquifer as the injection zone. The modified Theis equation for this case is (Driscoll 1986, p. 771):

$$Q = Kb(h_w - H_o)/528 \log(r_o/r_w) \qquad (1)$$

where

Q = injection rate in gpm = 437.5 gpm (Eq 1) = 84,218 ft^3/day (Eq 2) (App., p. 23.)
K = hydraulic conductivity = 99.65 gpd/ft^2 (Eq 1) =13.3 ft/day(Eq 2) (App., p. 9)
b = aquifer thickness from top of Amnicola clay to bottom of Tulare clay = 1200 ft (Attach. 8, Sec. A-A')
h_w = head above the bottom of aquifer while injecting =1433 ft (Eq. 2)
H_o = head above bottom of aquifer when no injecting is taking place = 1425 ft (Attach. 8, Sec. A-A')
r_o = radius of influence in feet
r_w = radius of injection well in feet = 0.36 ft (App., p. 17.)

The head above the bottom of the aquifer while injecting was calculated from the following equation (Baumann 1965,[12] p. 239):

$$h_w = (a_o^2 - Q/\pi K[\ln(r_w/L) + 0.72])^{1/2} \qquad (2)$$

where

a_o = initial depth of groundwater, from water table to top of Amnicola clay = 1,425 ft (Attach. 8, Sec. A-A').
$L = (10TKa_o/\mu)^{1/2}$ = 78,127 ft (Baumann 1965)
μ = porosity = 0.34 (App., p. 8.)
T = injection time = 10,950 days (30 yrs)

Substituting these values into Equation (2) yields the head above the bottom of the aquifer while injecting, h_w, which is 1,433 feet. Therefore, injection would create a mount of wastewater in the vicinity of the injection well that is 8 feet above the original elevation of the water table or 1433 ft - 1425 ft = 8 ft. Solving Equation (1) for r_o, yields the radius of influence of 4,980 ft without considering dispersion. Dispersion may be accounted for using the Applicant's procedure (Warner and Lehr 1981, p. 112):

$$r_o' = r_o + 2.3(Dr_o)^{1/2} \qquad (3)$$

[12] Paul Baumann, Technical Development in Ground Water Recharge, Advances in Hydroscience, v. 2, 1965.

where

D = dispersion coefficient = 65 ft (Warner and Lehr 1981, p. 112)
r_o' = radial distance of travel with dispersion.

Solving Equation (3) yields a radius of influence of 6,289 feet.

Thus, using the procedure recommended in 40 CFR 146.6 (a)(2), which accounts for local aquifer properties, yields a radius of influence (or "zone of endangering influence") that is substantially higher than the 950 feet to 0.5 miles assumed by the Applicant. This has three important consequences.

First, the injected wastewater would move beyond the boundary of the Elk Hills Oilfield, into nonexempt UDWSs south of the Oilfield. The southern extent of the wastewater plume would encompass the floodplain of Buena Vista Creek, which likely supports an alluvial aquifer that may be a UDWS.

Second, the zone of influence is large enough to encompass a large number of currently active oil production wells. (Application, Attach. 1.) These wells could serve as conduits that would allow injected wastewater to penetrate UDWSs.

Finally, the Application only reviewed information within the radius of review, which was selected as 0.5 miles. This analysis demonstrates that the area of review should have been at least 1.2 miles. This substantially expands the scope of the investigation that must be presented to support the UIC Application. For example, Attachment 1 shows that there are a number of additional abandoned wells within the 1.2 mile radius that were not included in the well review in Attachment 2. Therefore, the Applicant should be requested to update its Application to address this larger area of review.

[13] Bechtel, NPR-1 Ground Water Protection Management Program, April 1994, Revised February 1995.

Studies conducted in this area and cited by the Applicant suggest that injected wastewater from currently operating, nearby injection wells is currently moving out of the injection zone and adversely affecting local water quality. Benzene, which occurs at elevated concentrations in the currently injected produced water, has been found in the source wells within Section 18G. This study recommended that "a monitoring well be completed in the southeast corner of Section 18 G [where the proposed injection wells would be located] to determine if wastewater and the constituents associated with the wastewater are being sufficiently retarded in the exempt portions of the Tulare Formation and not migrating towards adjacent non-exempt areas located to the southeast in Section 20G." (Bechtel 2/95,[13] p. 7-5.) It does not appear that the recommended well has been installed based on information provided by the Applicant in Attachments 1 and 2. Therefore, and in light of the foregoing, we recommend that EPA require one or more monitoring wells to evaluate whether injectate moves outside of the exempt aquifer.

Location of Wells

The draft permit reports the location of the wells in "Section 18, T.31 S., R.24 E, in Kern County, California." (Permit, p. 4.) Notwithstanding the above, this is not an adequate description to assure that injectate remains within the exempt portion of the aquifer. Given this description, these wells could be located anywhere within Section 18. If they were located near the southern boundary of the section, for example, the zone of influence, irrespective of the method used to determine the area of review, would extend into nonexempt portions of the aquifer. Therefore, the draft permit should be revised to specify the latitude and longitude of the proposed wells, as is customary.[14]

[13] Bechtel, NPR-1 Ground Water Protection Management Program, April 1994, Revised February 1995.

[14] See, for example, UIC Permit No. HI596002, issued to Puna Geothermal Venture.